

**United Nations  
Environment  
Programme**Distr.  
GENERALUNEP/OzL.Pro/ExCom/91/66  
8 November 2022

ORIGINAL: ENGLISH



EXECUTIVE COMMITTEE OF  
THE MULTILATERAL FUND FOR THE  
IMPLEMENTATION OF THE MONTREAL PROTOCOL  
Ninety-first Meeting  
Montreal, 5-9 December 2022  
Item 11(c) of the provisional agenda<sup>1</sup>

**CRITERIA FOR A FUNDING WINDOW FOR AN INVENTORY OF BANKS OF USED OR  
UNWANTED CONTROLLED SUBSTANCES AND A PLAN FOR THE COLLECTION,  
TRANSPORT AND DISPOSAL OF SUCH SUBSTANCES  
(DECISION 90/49(C))**

**Introduction**

1. Discussions on the issue of the disposal of unwanted controlled substances under the Montreal Protocol have been taken up by the Executive Committee since its 78<sup>th</sup> meeting in the context of the development of the cost guidelines for the phase-down of HFCs in line with the Kigali Amendment. These discussions continued at the 82<sup>nd</sup>, 83<sup>rd</sup> and 84<sup>th</sup> meetings, where at the latter meeting, the Executive Committee requested the Secretariat to prepare a synthesis report describing best practices and ways for the Executive Committee to consider operationalizing paragraph 24<sup>2</sup> of decision XXVIII/2.<sup>3</sup> The Secretariat prepared this report (UNEP/OzL.Pro/ExCom/86/90) and submitted it to the 86<sup>th</sup> meeting, however due to the challenge in having a physical meeting due to the COVID-19 pandemic, the report was discussed only at the 89<sup>th</sup> meeting.

2. During the discussion in plenary at the 89<sup>th</sup> meeting, members welcomed the comprehensive report prepared by the Secretariat and noted that despite their mixed results, the ODS pilot projects had provided important lessons. Several members expressed support for the proposed recommendations in the document; while some suggested revisions to include strategies for environmentally sound management of ODS waste in plans that were currently being implemented and future plans for HFCs, but those revisions would require approval from the Executive Committee to ensure that the strategies were cost-effective.

3. There was also support for the development of a framework for countries to undertake inventories of banks of controlled substances, which was considered a first step in the sustainable management of those substances and would facilitate the identification of future actions, which could include disposal. The

<sup>1</sup> UNEP/OzL.Pro/ExCom/91/1.

<sup>2</sup> To request the Executive Committee to consider funding the cost-effective management of stockpiles of used or unwanted controlled substances, including destruction.

<sup>3</sup> Decision 84/87(b).

deliberations on the matter continued in the contact group on the development of cost guidelines for the phase-down of HFCs in Article 5 countries. After the discussions at the 89<sup>th</sup> meeting, the Executive Committee agreed to continue discussion of the matter at the 90<sup>th</sup> meeting, on the basis of a working text deliberated by members in the contact group.<sup>4</sup>

4. At the 90<sup>th</sup> meeting, following the report of the convener of the contact group on the HFC cost guidelines, the Executive Committee decided *inter alia* to request the Secretariat to develop, for consideration by the Executive Committee at its 91<sup>st</sup> meeting, criteria for a funding window to provide Article 5 countries with assistance to prepare an inventory of banks of used or unwanted controlled substances and to develop a plan for the collection, transport, and disposal (including consideration of recycling, reclamation, and cost-effective destruction) of such substances (decision 90/49(c)).

5. In response to decision 90/49(c), the Secretariat has prepared the present document for consideration of the Executive Committee.

6. The objective of this document is to develop the abovementioned criteria. The draft criteria will consider existing policies and best practices related to similar activities such as developing national inventories and will define the scope of those activities and the conditions under which these may be considered for support from the Multilateral Fund. It will also take into account the flexibility provided to Article 5 countries to include activities<sup>5</sup> related to the environmentally sound management of used or unwanted controlled substances, including disposal, in their refrigeration servicing sector plans in subsequent tranches of approved stages or new stages of HCFC phase-out management plans (HPMPs), and stage I of Kigali HFC implementation plans (KIPs).<sup>6</sup> For the purpose of this document, the priority for the national inventory will be those banks of used and unwanted refrigerants, but may include consideration of other substances from different applications,<sup>7</sup> when feasible. Annex I to the present document lists the definitions of terminology used in the present document; some of these are taken from documents and studies on the matter of disposal previously considered by the Executive Committee.<sup>8</sup>

7. In preparation of this document, the Secretariat reviewed the lessons learned from previous ODS disposal pilot demonstration projects, summarized in Annex II to the present document, including how these were integrated with national hazardous waste rules and regulations as these relate to understanding the banks of these unwanted substances. The Secretariat also reviewed some examples of national inventories prepared by Article 5 countries<sup>9</sup> with funding outside the Multilateral Fund, the methodology<sup>10</sup> used in developing these inventories, and the different activities associated with their preparation, to understand the specific needs of such activities and define the extent of actions that need to be undertaken while preparing inventories.

8. This document consists of the following sections:

- I. Sources of and challenges in the collection of used or unwanted controlled substances
- II. Key components for the preparation of national inventories of waste-controlled substances

---

<sup>4</sup> Annex III of document UNEP/OzL.Pro/ExCom/89/16.

<sup>5</sup> Activities listed in paragraphs 19 to 24 of document UNEP/OzL.Pro/ExCom/89/9.

<sup>6</sup> Decision 90/49(b).

<sup>7</sup> For example, foam or halon.

<sup>8</sup> Final draft of the study on the collection and treatment of unwanted ODS in Article 5 and non-Article 5 countries (UNEP/OzL.Pro/ExCom/54/Inf.3). and the draft report on criteria and guidelines for the selection of ODS disposal projects (UNEP/OzL.Pro/ExCom/58/19/Rev.1).

<sup>9</sup> ODS Bank Inventory, Islamic Republic of Iran, 2018, and Greenhouse Gas Inventory of the Refrigeration and Air-Conditioning Sector in Grenada, 2021.

<sup>10</sup> Guidelines to Conduct an ODS Inventory, GIZ, 2017.

- III. Development of a national plan for environmentally sound management of waste-controlled substances
- IV. Criteria for a funding window for the preparation of national inventories of banks of waste-controlled substances and national plans for the environmentally sound management of these substances
- V. Proposal for funding the preparation of national inventories of banks of waste-controlled substances/and national plans

#### Recommendations

### **I. Sources of and challenges in the collection of used and unwanted controlled substances**

9. Refrigerants account for the largest source of used and unwanted controlled substances available to be potentially recovered and/or disposed of in Article 5 countries. Currently, this would include significant quantities of HCFCs and/or HFCs and HFC-blends that are installed in existing equipment or had been contaminated during servicing; these may also include remaining amounts of ODS refrigerants<sup>11</sup> in old equipment<sup>12</sup> which will also need to be properly addressed.

10. The two main sources of used and unwanted controlled substances considered in this document where data for the national inventories may be derived from are:

- (a) Waste-controlled substances contained in equipment; and
- (b) Bulk stockpiles of waste-controlled substances.

#### Waste-controlled substances contained in equipment

11. During servicing, there are refrigerants recovered from equipment which may become contaminated and thus cannot be reclaimed or reused, which make these an important source of waste-controlled substances. Similarly, where old equipment is decommissioned and replaced, the substances that are still in the equipment including insulation, may also be considered as banks of these waste-controlled substances. In many Article 5 countries, the lack of awareness and information of where and how much of these substances is contained in banks<sup>13</sup> is a barrier to effective recovery and the environmentally sound management of these wastes. There is also significant cost associated with the tools and infrastructure needed to properly recover/collect, transport, store, and destroy these waste substances. In many Article 5 countries, a wide geographic range of these banks presents a significant obstacle to efficient collection, and eventual disposal.

12. The feasibility of recovering substances from equipment during servicing or end-of-life depends on a variety of factors, including availability of recovery equipment, economic feasibility of recovery, supporting regulatory measures, amounts to be recovered, and technical training. Most substances that can be easily recovered come from refrigeration and/or air-conditioning (AC) equipment, which primarily use HCFC and HFCs, and other blends. Where these substances cannot be recycled and re-used, these could be

---

<sup>11</sup> CFCs.

<sup>12</sup> Equipment at end-of-life.

<sup>13</sup> The report on Safeguarding the Ozone Layer and the Global Climate System (Intergovernmental Panel on Climate Change (IPCC)/Technology and Economic Assessment Panel (TEAP) 2005, defines ODS banks as the total amount of substances contained in existing equipment, chemical stockpiles, foams, and other products not yet released to the atmosphere.

collected for disposal from domestic appliances (such as refrigerators, freezers, room AC units). The foam from these equipment may also be collected for disposal, where feasible.

13. Without a dedicated waste recovery programme there is reason to believe that very limited recovery of refrigerants is occurring at the end-of-life of these appliances. In some countries, product stewardship schemes work well with the refrigeration/AC sectors; however, these programmes inherently incentivize the recovery of refrigerants from larger systems over smaller ones, leaving a void for the responsible handling of unwanted refrigerants contained in household appliances.

#### Bulk stockpiles of waste-controlled substances

14. Bulk stockpiles of ODS may originate from a variety of sources. For example, small quantities of substances that have been evacuated from refrigeration/AC during servicing or decommissioning may be consolidated into stockpiles for storage, and refrigerants recovered from large commercial and industrial equipment during servicing or decommissioning may be collected in sufficient quantities to be considered “bulk”. Some suppliers have active programmes to recover refrigerants from their customers. The material is analyzed for quality and either recycled or consolidated for disposal.

15. In addition, controlled substances that have been produced or imported but never used (i.e., confiscated at customs) may also be stored in stockpiles for later use<sup>14</sup> and/or disposal. As these stockpiles remain in storage, they typically leak, and over time, significant quantities of these substances can be emitted into the atmosphere, if not disposed of. This is especially the case when stored in original containers in locations where temperature and moisture are not controlled (e.g., warehouses, fields). To prevent bulked substances from being emitted into the atmosphere, it is important to properly dispose them in a timely manner. Since bulk stockpiles of used and unwanted controlled substances are already consolidated, collecting from these stockpiles for destruction is generally a cost-effective option.

## **II. Key components for the preparation of national inventories of waste-controlled substances**

16. One of the main barriers identified for the successful implementation of the ODS disposal projects funded by the Multilateral Fund was the absence of a national inventory of the targeted waste substances, resulting in a discrepancy in the amounts of ODS targeted for destruction and the actual amounts destroyed. This demonstrated a lack of understanding on where the waste substances were, and how these could be collected. It was recognized that for Article 5 countries to be able to design their strategies for environmentally sound management of waste-controlled substances, conducting a national inventory of banks of these used and unwanted controlled substances, establishing their locations, and estimating the amounts contained in these banks, would help to identify feasible actions required for the development of a national plan for their sound management and eventual disposal.

17. Once the inventory of banks is completed, the country would have a better understanding of which of these substances are re-usable and which are for disposal. This would facilitate the design of a national plan detailing the activities, policy and training requirements needed to manage these substances, the manner of their disposal (i.e., domestically destroyed or exported for destruction) and the costs. Where export of waste-controlled substances is economically viable, countries would need to consider national, regional, and international regulations on exporting these wastes.

18. The relevant national authorities in Article 5 countries would need to conduct meetings with stakeholders to initiate the preparation of these national inventories. There should be agreement among stakeholders on the objective of the inventories, the approach for how these inventories will be conducted; and the methodology to establish the framework for data collection and analysis. A review of the relevant

---

<sup>14</sup> Following national regulations for releasing these substances into the market.

policies and regulations related to recovery, recycling and reclamation and management of wastes is essential in order to identify those that would be needed to support the environmentally sound management of these wastes. It is important to note that the information collected on the inventory of banks will provide data only for the period the inventory was undertaken. Ensuring the inclusion of the supporting policies and regulations in the national plans would promote the sustainable management of these unwanted controlled substances.

#### Methodologies for data collection and analysis

19. The preparation of national inventories should build upon those activities including policies and regulations that exist in the country related to ODS and the management other controlled substances and should be linked to the national phase-out plans that the country is undertaking. An initial desk study of already available data from national surveys on consumption of HCFCs undertaken in the preparation of HPMPs, ODS alternatives surveys, equipment importers, recovery and recycling activities from waste management operators, and collection, dismantling and recovery of the waste refrigerants and other substances from end-of-life equipment should be undertaken. A sound understanding of waste sources is an essential step and the basis for undertaking the national inventory would be helpful to describe a methodology to be used for quantifying the amount of waste-controlled substances in the country.

20. The methodology for data collection defined by a country will depend on their national circumstances and initial information available from the desk study, noting that validating and updating this data will be the main purpose of this exercise. For instance, Article 5 countries may decide on a methodology that will collect data on equipment using controlled substances (data on number of units and share of refrigerants in each type using production figures, sales figures, etc.) for an identified time frame, including estimating the amounts of controlled substances installed in the existing systems. This may need to be validated in the field with information from service shops such as the number of equipment serviced, whether the refrigerants are recovered, recycled, or when contaminated, collected. When this data is collected, there needs to be an understanding of the calculation process that will be used to determine the quantity of controlled substances contained in the equipment inventory (i.e., determine average initial charge/system, recharge amounts, what is left in the equipment during time of servicing, age of equipment, average leakage rates).

21. Another approach would be to use a top-down method using the consumption data in the country instead of the installed equipment population, where data on past consumption of controlled substances (i.e., HCFC/HFC/other substances) is available, within a specified period. This consumption data would have to be broken down into the specific applications or sector use (i.e., refrigeration, AC, etc.) and assumptions would have to be made on their initial charge, refill, and service charge, and how much would be left at end-of-life. Where some countries have included in their licensing systems permit requirements for imports of equipment containing controlled substances, an indication of annual import by type of equipment will help better estimate their volume and refrigerant requirement. While it may be easier to collect consumption data as these are officially reported, it may be difficult to disaggregate such data into specific sectors using these substances.

22. It is important to ensure that all sectors where controlled substances are used are included in the data collection process to understand the scope of the banks and prioritize sectors where actions can be initiated in a cost-effective manner, as not all activities may be financially viable in all sectors.<sup>15</sup> It is fundamental that the methodology for data collection leads to a comprehensive analysis of the information collected during the preparation of the national inventories to ensure that the resulting strategy clearly describes the actions required to develop a sound strategy for waste-controlled substances. Both

---

<sup>15</sup> Results from the pilot ODS disposal projects show that the cost for the collection of foam and their destruction, while possible in some destruction facilities, are prohibitive and not affordable.

methodologies described above can be used either independently or in combination of the two depending on the national circumstances, to ensure better data collection.

#### Approaches used in the collection of waste-controlled substance

23. Collection activities are defined as all efforts to extract waste-controlled substances from an application (e.g., foam) or a product (e.g., refrigerator or other equipment), and aggregating the extracted substances until the necessary quantity reasonable for further processing is reached. Understanding the waste collection process in an Article 5 country is important so that the sources of these waste-controlled substances can be identified to support the inventory. This is also helpful to define the parameters and requirements for establishing a collection system, for countries where an organized approach is not in place.

24. There needs to be an understanding of what effective collection mechanisms are present in the country. Experiences from recovery and recycling projects included in national phase-out plans, particularly as it contributed to a systematic collection of ODS waste and other waste-controlled substances also needs to be considered to further understand the potential sources and banks of these waste substances in the country.

25. In some countries, there may also be a need to strengthen and enhance the participation of local stakeholders in the collection of waste substances from end-of-life equipment, when associated with an institutionalized system of recovery and recycling, home appliance replacement programme, potential confiscated illegal trade, and waste from other users.

#### Review of domestic regulations and programme supporting waste management

26. An assessment of the current regulatory framework and existing programmes that support actions on recovery, recycling and reuse of waste-controlled substances including those that mandate the waste collection efforts through initiatives such as an extended producer responsibility (EPR) programme or through servicing contracts/industry-administered partnerships need to be made. An insight into the links between the overall ODS national policy and the existing waste and hazardous waste management policies and regulations will guide the approach to be taken for the inventory.

27. This thorough review of national policies will help in understanding the sources of waste and support a more efficient data collection process. Eventually, such an analysis will help identify the gaps in the regulatory framework. This may encourage changes in the national policy and regulatory infrastructure to support or encourage collection, storage, analysis, tracking, certification of destruction and reporting requirements applicable to waste-controlled substances. This will also support the development of a concept for end-of-life treatment of equipment and substances.

#### Finalization of the national inventory report

28. The national inventory report will be finalised only after completing the data collection activity and the subsequent data analysis. The resulting document would need to be discussed in consultation with the relevant stakeholders both in government and in the private sector (i.e., waste management operators, collection centres, or waste aggregators, appliance retailers, refrigeration associations) to ensure their involvement and cooperation for future actions related to the management of these wastes.

29. Once the requisite consultations are concluded, the inventory report can be completed, which would then be the framework for further related actions on this matter.

### III. Development of a national plan for environmentally sound management of waste-controlled substances

30. The completed national inventory of banks is expected to provide the framework for Article 5 countries to develop a plan for the collection, transport and disposal of these waste-controlled substances and the blueprint for the environmentally sound management of waste-controlled substances. The objective would be to set up a systematic collection of ODS waste through coordinated and synchronized efforts between appliance/equipment replacement and recovery-and-recycling programmes, including options for storage, transport, and eventual disposal. This strategy would be best developed as part of the country's national phase-out plan (i.e., for this purpose, KIPs) from inception rather than considering it only at the end. This will ensure that an institutionalised collection process can be defined, and a waste stream will be assured. This would then allow countries to decide on options for destruction depending on the amount of waste collected. Lessons learned from the pilot ODS disposal projects showed that in many instances a more cost-effective option for the destruction of waste-controlled substances from Article 5 countries without their own destruction facilities and with small waste streams would be aggregating these for export to non-Article 5 countries for destruction.

31. While the finalization of the inventory of banks is essential to the preparation of a national action plan, some countries who already have a good understanding of their banks of waste-controlled substances and have a supporting regulatory framework, may wish to simply develop a plan of action for the storage, transport, and eventual disposal of these substances. In developing this national plan, the country may also undertake activities that could confirm the amounts of waste substances in the already identified banks, without preparing a full inventory.

32. The national plan of action is expected to describe and include the following:

- (a) An understanding of the sources and banks of waste-controlled substances in the country (inventory of banks);
- (b) Description of the existing and required policies and regulations supporting the management of waste-controlled substances including recovery and recycling (and reclamation, where applicable) based on the country's institutional and regulatory framework;
- (c) Defining the activities that need to be implemented for establishing an effective collection, transportation, storage mechanism and a functioning recycling and reclamation infrastructure, including a tracking system for recovered ODS and waste-controlled substances and their reuse;
- (d) Description of the responsible actors and their role in the process of collection, storage, transport, and eventual disposal of unwanted controlled substances;
- (e) Assessing technology options for disposal, including destruction noting best practices, and potential opportunities for co-disposal of waste-controlled substances with other hazardous waste (e.g., persistent organic pollutants (POPs) waste), especially for those countries with very small ODS waste streams;
- (f) Understanding the impediments for the establishment of domestic destruction capacity and the export of waste for destruction;
- (g) Addressing the institutional framework needed to support the sustainable management of waste-controlled substances, including eventual disposal and the options identified noting monitoring and verification procedures required for; and

- (h) Cost considerations of disposal and destruction options including options for financing.

#### **IV. Criteria for a funding window for the preparation of national inventories of banks of waste-controlled substances and national plans for the environmentally sound management of these substances**

33. The funding window is expected to support interested Article 5 countries to develop national inventories of banks and national plans which would include the elements described in paragraphs 16 to 32 above. The resulting national plan would describe the strategy for environmentally sound management of waste-controlled substances leading to the long-term sustainability of used and unwanted controlled substances management, and eventual disposal including destruction if required. In determining the criteria for this funding window, the following elements will have to be considered.

##### Scope of the funding window

34. This funding window will be limited to and include only those requests from Article 5 countries for activities related to undertaking an inventory of banks of used or unwanted controlled substances including the development of a plan for the collection, transport, and disposal, including consideration of recycling, reclamation, and cost-effective destruction of such substances. Priority will be provided to those countries who have not previously received funding under decision 58/19.<sup>16</sup> Likewise, those Article 5 countries who used the flexibility provided to include activities related to the environmentally sound management of used or unwanted controlled substances, including disposal in their refrigeration servicing sector plans under their HPMP or KIP consistent with decision 90/49(b), will be provided further assistance only after receipt of a strong justification for the requested funding.

##### Timing of project submissions

35. Projects that may be considered under this funding window should be submitted for the consideration of the Executive Committee from the 93<sup>rd</sup> meeting up to and including the 97<sup>th</sup> meeting if these are included in the business plans for 2024-2026 considered by the Executive Committee at its 93<sup>rd</sup> meeting.

##### Eligibility

36. The following conditions may be applied to projects under this funding window:
- (a) The preparation of the national inventory of banks of used or unwanted controlled substances and eventual plan would result in the improvement of the current infrastructure needed to support the environmentally sound management of waste-controlled substances in the country, and integrated with the development and/or implementation of national plans to phase out/down controlled substances;
  - (b) The concept, methodology and approach to be taken for the preparation of the national inventory/action plan needs to be concretely described and clearly linked to other activities in the country (i.e., national plans like the KIP), in particular those activities in the refrigeration servicing sector such as recovery, recycling, and reclamation programmes;
  - (c) For those national plans that may include, in addition to approaches for the collection, transport, storage and disposal specifically the destruction of waste-controlled substances, a description for a potential business model detailing arrangements with various stakeholders, private sector commitment and involvement in these activities, from waste

---

<sup>16</sup> Decision 58/19 Interim guidelines for the funding of demonstration projects for the disposal of ODS



collection to eventual destruction shall be included in the submission; and

- (d) Where the national plans identify export for destruction as the most cost-effective option, an indication that national legislation and policies consistent with the requirements of the relevant conventions particularly as it relates to transboundary movement of these wastes needs to be in place.

#### Monitoring and reporting

37. Where activities under this funding window are approved by the Executive Committee, these projects will be subject to the regular reporting mechanism under progress reporting. In addition, those activities funded under this window are expected to submit copies of their national inventories and the resulting action plans for consideration of the Executive Committee no later than six months after the project is completed. These reports should highlight the difficulties and lessons learned through this exercise, to provide the Executive Committee with information on the outcomes of the inventories.

38. The action plans related to the collection, transport, and disposal of these waste-controlled substances, especially as these relate to activities for recovery and recycling in the servicing sector are expected to be integrated into the implementation of the national plans of the countries concerned. This will facilitate further reporting of these actions in the context of these national phase-out plans.

#### **V. Proposal for funding the preparation of national inventories of banks of waste-controlled substances and national plans**

39. In understanding the cost components required for the preparation of these national inventories, the Secretariat reviewed previous funding elements for similar technical assistance activities linked to the development of national phase-out plans (i.e., HPMPs, KIPs), enabling activities, surveys of ODS alternatives and pilot demonstration projects on ODS disposal. Based on this analysis, the funding levels for the preparation of national inventories and plans may be based on the following activities that need to be undertaken during this preparation:

- (a) Desk study preparation
- (b) Data survey, collection, and analysis (including consultant costs)
- (c) Data synthesis and preparation of the final inventory report
- (d) Consultations with stakeholders (meetings and workshops)
- (e) Preparation of the national plan including report reproduction and printing costs

40. The components listed above will be common to all countries seeking assistance for this activity; however, the level of complexity will vary with country size and consumption. To ensure equity of funding for countries that wish to develop these inventories and plans, the Secretariat considered that funding may be determined based on HCFC baseline consumption as a proxy, using the same basis for determining the funding for the preparation for KIPs. These costs also assume that some of the actions linked to the activities listed in paragraph 39 above would form part of those that the national ozone units (NOUs) will be undertaking while implementing other Montreal Protocol related initiatives that may already be funded by the Multilateral Fund.

41. Based on the review, the Secretariat did a bottom-up analysis to assess the funding levels of the main activities required for this activity. Table 1 shows the proposed funding levels for the preparation of national inventories of banks of used or unwanted controlled substances including the development of a

plan for the collection, transport, and disposal, including consideration of recycling, reclamation, and cost-effective destruction of such substances.

**Table 1: Funding levels for the preparation of national inventories of banks and a national plan for the management of waste-controlled substances for Article 5 countries**

HCFC baseline (ODP tonnes)	Funding for the preparation of national inventories of banks of waste-controlled substances and action plan (US \$)
Below 1	40,000
Between 1 and 6	60,000
Above 6 and up to 100	80,000
Above 100	90,000

42. Based on the experience gained and lessons learned from similar technical assistance activities and from the pilot ODS disposal projects and the results achieved during their implementation, the Executive Committee may request confirmation from governments of Article 5 countries who wish to submit projects under this funding window, that the country through the implementation of their national phase-out/phase down plans (i.e., HPMPs/KIPs) will endeavour to establish supporting regulation on refrigerant recovery and recycling which would support the actions identified for the collection, transport, storage, and disposal of these used and unwanted waste-controlled substances, as part of the resulting strategy for the environmentally sound management of waste-controlled substances.

## Recommendation

43. The Executive Committee may wish:

- (a) To note the criteria for a funding window for an inventory of banks of used or unwanted controlled substances and a plan for the collection, transport, and disposal of such substances contained in document UNEP/OzL.Pro/ExCom/91/66;
- (b) To consider the following criteria for the preparation of national inventories of banks of waste-controlled substances and the subsequent plan for the collection, transport, and disposal:
  - (i) That the requests will be limited to and include only those requests from Article 5 countries for activities related to undertaking an inventory of banks of used or unwanted controlled substances including the development of a plan for the collection, transport, and disposal that includes consideration of recycling, reclamation, and cost-effective destruction of such substances, within the framework described in paragraphs 16 to 32 of this document;
  - (ii) That priority will be given to those countries who have not previously received funding from the pilot ODS disposal demonstration projects, and where these countries request for further assistance, the funding to be provided may be adjusted accordingly at the time of project submission and consistent with guidance from the Executive Committee;
  - (iii) That those Article 5 countries who used the flexibility provided to include activities related to the environmentally sound management of used or unwanted controlled substances, including disposal in their refrigeration servicing sector plans under their HCFC phase-out management plans (HPMPs) or Kigali HFC implementation plans (KIPs) consistent with decision 90/49(b), further assistance will be provided only after receipt of a strong justification for the requested funding;

- (iv) That projects under this funding window be submitted for the consideration of the Executive Committee from the 93<sup>rd</sup> meeting up to and including the 97<sup>th</sup> meeting only, after these are included in the business plans for 2024-2026 to be considered by the Executive Committee at its 93<sup>rd</sup> meeting;
- (v) That the national inventories and resulting action plan should be completed no later than 24 months from the date of approval by the Executive Committee;
- (vi) That projects submitted for funding would ensure that the following conditions are met:
  - a. The preparation of the national inventory of banks of used or unwanted controlled substances and eventual plan would result in the improvement of the current infrastructure needed to support the environmentally sound management of waste-controlled substances in the country, and integrated with the development and/or implementation of national plans to phase out/down controlled substances;
  - b. The concept, methodology and approach to be taken for the preparation of the national inventory/action plan needs to be concretely described and clearly linked to other activities in the country (i.e., national plans like the KIPs), in particular those activities in the refrigeration servicing sector such as recovery, recycling, and reclamation programmes, where relevant;
  - c. For those national plans that may include, in addition to approaches for the collection, transport, storage and disposal specifically the destruction of waste-controlled substances, a description for a potential business model detailing arrangements with various stakeholders, private sector commitment and involvement in these activities, from waste collection to eventual destruction shall be included in the submission;
  - d. Where the national plans identify export for destruction as the most cost-effective disposal option, an indication that national legislation and policies consistent with the requirements of the relevant conventions particularly as it relates to transboundary movement of these wastes needs to be in place;
- (c) That projects submitted for consideration should include a confirmation from the Government that the country will, through the implementation of their national phase-out/phase-down plans (i.e., HPMPs or KIPs) endeavour to establish supporting regulation on refrigerant recovery and recycling which would support the actions identified for the collection, transport, storage, and disposal of these used and unwanted waste-controlled substances, as part of the resulting strategy for the environmentally sound management of waste-controlled substances in the country;
- (d) To consider whether to establish a funding window for the preparation of national inventories of banks of used or unwanted controlled substances including consideration of recycling, reclamation, disposal and cost-effective destruction;
- (e) To consider, if the funding window is established, the funding for the preparation of national inventories banks of used or unwanted controlled substances including consideration of recycling, reclamation, and cost-effective destruction within the framework described in paragraphs 16 to 32 of this document, following the table below:

<b>HCFC baseline (ODP tonnes)</b>	<b>Funding for the preparation of national inventories of banks of waste-controlled substances and national action plan (US \$)</b>
Below 1	40,000
Between 1 and 6	60,000
Above 6 and up to 100	80,000
Above 100	90,000

- (f) To consider, if the funding window is established, requesting bilateral and implementing agencies:
- (i) To include the requests for the preparation of national inventories of used and unwanted substances and the subsequent action plans for Article 5 countries who wish to do so in their business plans for 2024-2026 to be submitted to the 93<sup>rd</sup> meeting;
  - (ii) To report in detail on the progress of the preparation of the national inventory of used and unwanted substances and subsequent action plan on an annual basis, as part of the annual financial and progress reports; and
  - (iii) To submit a final report and a copy of the resulting national inventories and the national action plans no later than six months after the project is completed, highlighting the difficulties and lessons learned.

## Annex I

### DEFINITIONS OF TERMINOLOGY ON THE MATTER OF DISPOSAL

**Banks** - sources of waste-controlled substances (i.e., refrigerant) contained in installed equipment currently in use or at its end-of-life, or stored in cylinders (i.e., unusable, or confiscated substances)

**Collection** - efforts to extract waste substances from a product (e.g., refrigerator or other equipment), and aggregating a significant quantity of waste-controlled substances in larger leak-tight containers/cylinders (i.e., isotanks) from service shops, recovery and recycling centres, and other sources, at a site for interim storage ready for transport for either domestic or exported for destruction.

**Disposal** - the method used to eliminate a substance that will no longer be used for the original purpose for which it was made. The method may include transformation, destruction, or disposal as a hazardous waste if mixed with other substances.

**Destruction process** - any combination of unit operations and unit processes, including piping and instrumentation, that is used to destroy ODS/waste-controlled substances. Included in the process are any add-on or supplementary pollution control equipment required to minimize product and environmental releases. Under the Montreal Protocol, this can be done only using destruction technologies approved by the Meeting of the Parties and operating them taking into account the Code of Good Housekeeping as per the Annex III of the report of the Fifteenth Meeting of the Parties.

**End-of-life management** - handling of decommissioned equipment and the waste-controlled substances contained in these

**National inventories of banks** - reports containing information on the total stock of waste-controlled substances either contained in existing equipment or end-of-life decommissioned equipment, aggregated or bulk waste substances that have been collected and accumulated in containers or cylinders

**Recovery** - the collection and storage of controlled substances from machinery, equipment, containment vessels, etc., during servicing or prior to disposal without necessarily testing or processing it in any way.

**Recycling** - cleaning a recovered controlled substance following basic processes such as filtration, dehydration, distillation, or other means to make it pure to a level that meets industry requirements for re-use. For refrigerants, recycling normally involves recharge back into equipment and it often occurs “on-site”

**Transport** - the method by which aggregated waste-controlled substances that are stored in leak-proof containers or cylinders are transferred from any recovery/recycling or aggregation centre either to a storage facility prior to disposal or directly to the destruction facility itself, either in-country or for export

**Waste (used or unwanted) controlled substances** - includes ODS/HCFCs/HFCs, or any substance controlled under the Montreal Protocol that have been rendered unusable or unwanted, and/or classified as waste; stockpiles of remnants of already phased out substances



## Annex II

### OVERVIEW OF THE PILOT ODS DISPOSAL PROJECTS (Annex I of document UNEP/OzL.Pro/ExCom/89/9)

1. At its 57<sup>th</sup> meeting, the Executive Committee decided to look at pilot ODS disposal projects that would respond to decision XX/7<sup>1</sup> of the Meeting of the Parties that specified that pilot projects could cover the collection, transportation, storage and destruction of ODS, with a focus on assembled stocks with high global warming potential (GWP) in a representative sample of regionally diverse Article 5 countries. The decision also postulated that ODS disposal demonstration projects should be feasible and include methods of leveraging co-funding (decision 57/6).
2. At its 58<sup>th</sup> meeting, the Executive Committee adopted interim guidelines for the funding of demonstration projects for the disposal of ODS (decision 58/19). Funding for the preparation of ODS destruction pilot project proposals had been approved since the 54th meeting. Subsequently, at its 63<sup>rd</sup> meeting, the Executive Committee decided to set a window for ODS destruction for low-volume-consuming (LVC) countries, pursuant to decision XXI/2 (decision 63/5(c)<sup>2</sup>).
3. Between the 54<sup>th</sup> to the 73<sup>rd</sup> meetings, the Executive Committee approved 16 project preparation funding that resulted in fully developed pilot demonstration projects for ODS waste management and disposal in 11 countries, two regional projects and one for technical assistance with a total funding of US \$11,528,052. These included two regional ODS disposal demonstration projects, for Asia and the Pacific (ASP), and for Europe and Central Asia (ECA). The preparation funding provided for one country and one region did not result in complete projects and were cancelled.<sup>3</sup> In addition, the Executive Committee approved three technical assistance programmes (i.e., Nepal, regional strategy for Africa<sup>4</sup> and a global project<sup>5</sup>), resulting in a total of 12 projects approved, as shown in Table 1. These projects were approved in line with decision 58/19, interim guidelines for ODS waste disposal projects.

**Table 1. Pilot ODS disposal projects approved**

Country	Region	Agency	Meeting	Funds (US \$)
<i>Approvals for project preparation for ODS disposal demonstration projects</i>				
Algeria	Africa	UNIDO	59	85,000
Region: ASP	Asia and the Pacific	Japan	54	30,000
Brazil	Latin America	UNDP	57	40,000
Colombia	Latin America	UNDP	59	40,000

<sup>1</sup> To request the Executive Committee to consider as a matter of urgency commencing pilot projects that may cover the collection, transport, storage, and destruction of ozone-depleting substances. As an initial priority, the Committee might consider projects with a focus on assembled stocks of ODS with high net GWP, in a representative sample of regionally diverse Article 5 countries. This initial priority would not preclude the initiation of other types of pilot projects, including on halons and CTC, should these have an important demonstration value. In addition to protecting the ozone layer, these projects will seek to generate practical data and experience on management and financing modalities, achieve climate benefits, and would explore opportunities to leverage co-financing; and to note that any project implemented pursuant to the present decision when applicable should be done in conformity with national, regional, and/or international requirements, such as those mandated by the Basel Convention and Rotterdam Convention.

<sup>2</sup> To set a window for ODS destruction for low-volume-consuming countries, pursuant to decision XXI/2 of the Twenty-first Meeting of the Parties, amounting to US \$3 million.

<sup>3</sup> India, and the regional project for Asia and the Pacific submitted by Japan.

<sup>4</sup> The strategy for disposal and destruction of ODS for five countries (Central African countries (Burundi, Cameroon, Central African Republic, Congo and Guinea) was submitted without project preparation funding. It proposed to develop a regional strategy for LVC countries to address unwanted ODS stockpiles. However, due to difficulties in implementation, the project was cancelled.

<sup>5</sup> The global project for the World Bank was a study designed to explore opportunities for financing ODS destruction; it was approved outside the guidelines for ODS disposal projects and was not included in the synthesis report.

Country	Region	Agency	Meeting	Funds (US \$)
China	South Asia	UNIDO	59	85,000
Cuba	Caribbean	UNDP	59	40,000
Region: EUR	Europe	Czech Republic	65	35,000
		UNIDO	65	35,000
Georgia	Europe	UNDP	65	30,000
Ghana	Africa	UNDP	65	30,000
Indonesia	Southeast Asia	IBRD	64	50,000
India	South Asia	UNDP	57	80,000
Lebanon	West Asia	UNIDO	57	85,000
Mexico	Latin America	UNIDO	61	50,000
		IBRD	61	50,000
Nigeria	Africa	UNIDO	57	60,000
Philippines (the)	Southeast Asia	IBRD	58	50,000
Turkey	Europe	UNIDO	60	60,000
<i>Approvals for ODS disposal demonstration project implementation</i>				
Region: AFR*	Africa	France	68	80,000
Algeria	Africa	France	72	250,000
		UNIDO	72	375,059
Brazil	Latin America	UNDP	72	1,490,600
Colombia	Latin America	UNDP	66	1,195,000
China	South Asia	UNIDO	67	1,227,885
		Japan	67	900,000
Cuba	Caribbean	UNDP	62	525,200
Region: EUR	Europe	UNEP	69	75,000
		UNIDO	69	274,480
Georgia	Europe	UNDP	69	55,264
Ghana	Africa	UNDP	63	198,000
Global*	Global	IBRD	55	250,000
Lebanon	West Asia	UNIDO	73	123,475
Mexico	Latin America	UNIDO	63	927,915
		France	63	500,000
Nepal*	South Asia	UNEP	59	157,200
Nigeria	Africa	UNIDO	67	911,724
Turkey	Europe	UNIDO	66	1,076,250
<b>Total</b>				<b>11,528,052</b>

\*Technical assistance

4. A final report was expected for each project that should cover the amounts of the different ODS collected, transported, stored and destroyed, as well as financial, managerial and co-funding arrangements, and any other issues relevant to the project implementation. Based on the draft guidelines, the Secretariat reviewed the projects, and reported to the Executive Committee at its 64<sup>th</sup> meeting<sup>6</sup> and 70<sup>th</sup> meeting.<sup>7</sup>

5. The following challenges on project implementation were observed:

- (a) For project preparation, on average, it took between nine to 40 months before the final projects were submitted for consideration of the Executive Committee, and between five to 72 months for the projects to be completed and final reports submitted;

<sup>6</sup> UNEP/OzL.Pro/ExCom/64/49 Report on the experience gained in the implementation of the disposal projects (decision 58/10).

<sup>7</sup> UNEP/OzL.Pro/ExCom/70/54 Report on progress and experiences gained in demonstration projects for the disposal of ODS (decision 64/50).



- (b) The information that needed to be included in the proposals was not easy to obtain; frequently, it was cited as the reason for the delays in submitting the project for funding. Specifically:
- (i) Difficulties were encountered in examining the national policy and regulatory infrastructure in place, and to link the potential project with existing similar initiatives for chemical waste management to develop synergies for the projects; and
  - (ii) Identifying sources of co-financing the project and developing the business model, and in some cases, the downturn in the carbon markets made this an unsustainable source of co-financing;
- (c) Delays were experienced in getting agreement with the country with respect to the approach for ODS disposal;
- (d) The survey and aggregation of already collected ODS took longer than expected; and
- (e) Some countries gave priority to completing HPMPs both during project preparation and implementation of the ODS disposal projects.

### Lessons learned from pilot ODS disposal projects

6. The synthesis report presented in document 82/21 gave a detailed analysis of only nine out of the 13 approved pilot projects on ODS disposal, and two studies for the establishment of a private-public financing system for disposal of ODS, for which final reports were received by the Secretariat as listed in table 2.

**Table 2. Completed ODS disposal demonstration projects**

Country	Project
China	Pilot demonstration project on ODS waste management and disposal
Colombia	Demonstration project on end-of-life ODS management and destruction
Georgia	Pilot demonstration project on ODS waste management and disposal
Ghana	Pilot demonstration project on ODS waste management and disposal
Indonesia*	Project preparation for a pilot demonstration project for ODS waste management and disposal
Mexico	Demonstration project for disposal of unwanted ODS
Nepal	Demonstration project for disposal of unwanted ODS
Nigeria	Demonstration project for disposal of unwanted ODS
Turkey	Demonstration project for disposal of unwanted ODS
Philippines (the)*	Project preparation for a pilot demonstration project for ODS waste management and disposal
Region: EUR	Demonstration of a regional strategy for ODS waste management and disposal in Europe and Central Asia

\*Report of a study only.

7. The report summarized the information presented in each report according to the different categories of activities associated with ODS disposal, the approaches used for ODS waste collection, the options used for transport, the destruction methods considered and applied in each project, related policies and regulations, synergies with other projects, and the business models for financial set up of the various approaches used.

8. The report also observed that the cost of destroying ODS waste in Article 5 countries appeared to be substantially higher than in non-Article 5 countries (as shown in Table 3). Based on the differences in

destruction costs, and notwithstanding the additional transportation costs required for exporting ODS waste, it appears that in many instances a more cost-effective option for the destruction of ODS waste from Article 5 countries without their own destruction facilities would be to export such waste to non-Article 5 countries for destruction.

**Table 3. Cost of destruction reported for the pilot projects**

Country	Destruction method	Cost of destruction (US \$)
China	Domestic - rotary kiln incineration	8.00 – 12.50
Colombia	Domestic - high temperature incineration (HTI)	5.20 (for CFC-11 foam) <sup>a</sup>
		5.98 (for liquid CFC-11) <sup>a</sup>
		6.20 (for gas CFC-12) <sup>a</sup>
Georgia	Exported to France – HTI	5.99 <sup>b</sup>
Ghana	Exported to Poland – HTI	No cost for destruction provided
Mexico <sup>c</sup>	Domestic – argon plasma arc	7.50
	Domestic – cement kiln incineration	6.00
Nigeria	Domestic – rotary kiln incineration	29.82 <sup>d</sup>
Region: ECA	Exported to Germany and Poland – rotary kiln incineration	1.87 to 2.45 <sup>e</sup>
Turkey	Exported to Poland – rotary kiln incineration	1.87 to 2.45 <sup>e</sup>

<sup>a</sup> Indicative commercial pricing from TECNIAMSA based on test burn results, based on solid foam.

<sup>b</sup> Based on 1.5 mt ODS destroyed, includes transportation abroad and actual destruction including inland and maritime transportation.

<sup>c</sup> Mexico identified the cost of US \$1.4/kg for transport and consolidation of ODS waste within Mexico.

<sup>d</sup> Based on 1.66 mt ODS destroyed, includes transportation costs.

<sup>e</sup> Destruction cost in Euros is 1.64-2.15/kg.

9. The projects also offered a view of the activities necessary for environmentally sound management of ODS waste. The observations from the reports include factors that determine the sustainability of destruction, which are summarized below:

(a) For LVC countries:

- (i) More efficient collection, dismantling and recovery of the ODS waste refrigerant lowers transaction and operational costs considerably;
- (ii) Aggregating waste from nearby countries or regions may be an option to ensure that enough is aggregated for cost-effective transportation and destruction, given due consideration to national/regional regulations on hazardous waste movement;
- (iii) Close coordination among the different stakeholders responsible for all stages of the management of ODS waste, is essential to ensure that all activities are implemented efficiently; and
- (iv) Public awareness is an important aspect, particularly in cases where it is important for the public to be made aware of the appliance replacement programme to encourage more owners to participate;

(b) Project design and sustainable business model:

- (i) Due to the long implementation period of the demonstration projects and the focus on CFCs, additional qualification testing of incineration facilities with other wasted refrigerants (i.e., HCFCs and HFCs) may be necessary to ensure that these can be used for these relevant EOL substances;
- (ii) Aligning the design of ODS destruction projects to procedures of the voluntary carbon markets could provide an opportunity for sustaining funding for such

activities; and

- (iii) Putting in place a cost-effective and sustainable EPR system based on an industry-administered partnership is necessary to ensure a waste stream that will make destruction efforts profitable and sustainable;
- (c) Regarding synergies with other destruction activities for hazardous chemicals:
- (i) Co-disposal of ODS waste and other hazardous waste (e.g., POP waste) provides opportunities for economies of scale leading to cost-effective disposal options, especially for those countries with very small ODS waste streams;
  - (ii) Exploring synergies with other multilateral environmental agreements, in particular with those that relate to climate change and chemical management, could be considered;
  - (iii) The requirements of the Basel Convention do not preclude countries from exporting ODS waste for destruction in line with the requirements of that Convention; and
  - (iv) Integrating ODS disposal issues within the national strategy of waste management linked with other aspects, such as energy efficiency, offers prospects for a sustainable ODS waste stream from replaced EOL equipment.

#### **Summary of country reports for completed ODS disposal projects.**

10. A summary of the information presented in the 11 reports received are presented in detail below.

China: Final report on the pilot demonstration project on ODS waste management and disposal (Government of Japan and UNIDO)

11. The objective of the pilot demonstration project is to explore treatment to the collected ODS wastes, set up a sustainable model for ODS wastes destruction, and the disposal of 192.0 metric tonnes (mt) of ODS wastes, particularly CFC banks.

12. The Regulation on ODS Management, which became effective in June 2010, is the basis for ODS recycling. It stipulates *inter alia* that enterprises specialized in the servicing and scrapping of refrigeration equipment, refrigeration and fire-extinguishing systems that contain ODS, shall be recorded under the local environmental protection bureaus (EPBs) and shall collect, recycle the ODS or transfer them to enterprises specialized in their collection, recycling, and destruction to give proper treatment to ODS.

13. The project had provided for local EPBs to undertake verification activities such as on-site visits, and collect information on ODS recycling enterprises, destruction procedures applied and related cost; and record ODS recycling equipment and its operational status. The verification of some large refrigeration servicing facilities found that this sector only uses HCFCs (i.e., there are no CFCs for disposal).

14. The total amount of CFCs destroyed amounted to 194.793 mt, consisting of 11.788 mt of CFC refrigerants, 172.005 mt CFC in foam wastes and 11 mt of CFC-11 used as a blowing agent. All the collected wastes were incinerated using rotary kilns. The disposal cost for ODS-related foam wastes and refrigerants comprised direct and indirect costs. Direct costs included those related to energy including electricity and gas, water and other materials for flue gas treatment and testing. Indirect costs included shared investment of fixed asset, overheads, management, and others (e.g., taxes). Although the costs vary among provinces, the average cost of destruction ranged from US \$8.00/kg to US \$12.50/kg.

15. The demonstration project has validated that the rotary kiln technology is efficient for the destruction of CFC-12, CFC-11 and CFC-11-based foams although the cost of operation is relatively high. Optimization of the destruction process is recommended in order to improve efficiency and reduce cost. While there are hazardous wastes disposal facilities available in some provinces, these are operating at full capacity dealing with other solid wastes. Considering the potential ODS waste coming from HCFCs and HFC-based products in the coming years, additional disposal facilities may need to be established in future.

Colombia: Final report on the demonstration project on end-of-life ODS management and destruction (UNDP)

16. The objective of the pilot project is to demonstrate a sustainable approach for ODS waste management from collection to destruction, by strengthening destruction capabilities of domestic facilities integrating them into broader hazardous waste, and energy efficiency initiatives. It proposed to address the disposal of 114 mt of ODS wastes for destruction; put in place measures to support the sustainability of the project taking into account ODS wastes that will be collected through the refrigeration servicing sector, and supported by policy initiatives now being implemented.

17. The ODS waste disposal project was implemented within a broader national policy framework of an integrated approach to hazardous waste management, energy efficiency, management of greenhouse gas emissions and the commitment to meeting the obligations under the Montreal Protocol. This included a priority attached to the environmentally sound management of end-of-life ODS as a result of national policy initiatives in the areas of refrigeration and air-conditioning. It was also supported by a sustainable Extended Producer Responsibility Programme that started in 2013, which progressed from a voluntary pilot phase to a mandatory system.

18. The demonstration test burn work showed that a domestic capability is qualified in principle, for the destruction of ODS, specifically CFC-11 and HCFC-141b-based foam and CFC-11 and CFC-12 chemicals up to established limits of chlorine feed content. While the destruction facility met the destruction efficiency requirements, there were limitations related to air emissions, particularly acid gases (hydrochloric acid (HCl) and hydrogen fluoride (HF)) that limit chlorine and fluorine content of the feed, impacting the productivity and cost-effectiveness of the destruction tests. The cost-effectiveness for destruction of CFC-11 and CFC-12 chemicals was estimated at half the cost-effectiveness specified by the Multilateral Fund (i.e., US \$13.20/kg). However, for the destruction of foam, the cost-effectiveness was estimated at approximately four times the threshold and, therefore, not affordable. Based on this, the current option is either the use of an electric arc furnace steelmaking plant processing intact refrigerator cabinet and doors, or a commercial cement kiln to destroy foam and potentially ODS refrigerant. Depending on the option selected, overall cost estimates range from US \$6.40 to US \$12.30 per refrigerator.

Georgia: Pilot demonstration project for ODS waste management and disposal (UNDP)

19. The objective of the pilot project for Georgia was to demonstrate how barriers to destruction and management of unwanted ODS can be overcome through synergies between ODS waste and persistent organic pollutants (POPs) stockpiles, and the disposal of 2.13 tonnes of unwanted ODS wastes that had already been collected and were temporarily stored in facilities in the country.

20. The final report focused on the activities done jointly by the focal areas, where both waste streams were co-disposed in a cost-effective manner. Terms of reference and a tender document were prepared for the co-disposal process to identify a waste sub-contractor that could collect, aggregate, pack and transport the obsolete POPs and the ODS waste to a destruction facility in France. The policy framework on hazardous waste management was reviewed to consider both ODS and POPs wastes in a comprehensive manner.

21. One key factor to the project's success was the close coordination between two separately funded activities, with the support of the Government. Joint project management through one consolidated tender, one sub-contractor and one process followed for waste export permitting procedures resulted in overall savings. In addition, having smaller waste streams, ODS waste disposal will in future continue to benefit from joint export with POPs waste, where under the Stockholm Convention it is a national obligation to destroy such hazardous waste. Experience showed that implementation of such joint projects takes longer time for preparation and identification of companies with expertise of both wastes. This project allowed for such a system to be put in place.

22. The project resulted in the disposal of 1.2 mt of waste ODS, an amount lower than what had been originally targeted. This was due to deterioration of the tanks where CFCs were stored which may have resulted in gas leakage. The project identified all sources of ODS waste in the country; supported by legislation, such collection would continue in future.

23. With regard to the sustainability of the project, Georgia is currently in the process of establishing a National Environmental Fund to include funds collected from penalties associated with illegal ODS trade. This fund may thus be used for additional exports of ODS waste in the future.

#### Ghana: Pilot demonstration project for ODS waste management and disposal (UNDP)

24. The project for Ghana proposed to dispose 8.8 tonnes of CFC-12 that had already been collected and were ready for destruction, and to put in place measures to support the sustainability of the project by considering other potential ODS waste that could be collected nationally under a project on energy efficiency (EE) funded by the Global Environment Facility (GEF).

25. The final report provided details on project implementation, the set-up of the operations in particular the synergy between the pilot demonstration project and the GEF-funded project, procurement of equipment (e.g., portable recovery machines from Germany, laboratory equipment, refrigerant identifiers, refrigerant cylinders), and the results of the destruction process. It indicated that a total of 1.2 mt of CFCs and 5.2 mt of methyl bromide were destroyed through a facility in Poland (Veolia), and an additional 1 mt of CFC was exported for destruction at a facility in the United States of America (Tradewater). Thus, the total ODS waste destroyed amounted to 7.4 mt.

26. Some of the challenges faced during implementation included: difficulties in aggregating wastes in sufficient amount for a cost-effective destruction; instability of the carbon markets which was seen as a driver for the interest in export for destruction; internal process of getting clearances for exporting a mixture of waste to Poland and the United States of America (i.e., persistent organic pollutants (POPs), polychlorinated biphenyl (PCBs) and ODS); and addressing stocks of collected foam containing CFC-11 and its destruction.

27. One main lesson learned from the project was the importance of cooperation between projects of complementary nature, in this case the GEF-funded appliance replacement and rebate scheme and the pilot waste destruction project funded by the Multilateral Fund. While the approach was complex, combining these waste streams provided a cost-effective solution for destruction, saving on transport and destruction costs. This has also led to collaboration between Ghana's Energy Commission and Environmental Protection Agency, the two agencies responsible for the GEF and Multilateral Fund projects, respectively.

#### Mexico: Final report on the demonstration project for disposal of unwanted ODS (UNIDO)

28. The objective of the pilot demonstration project for Mexico was the disposal of the 166.7 metric tonnes (mt) of CFC-12 from old refrigerators and air-conditioners, and 7.0 mt from chillers. The demonstration project destroyed 113.0 mt of unwanted CFC-12.

29. In addition to ozone and climate benefits, the project encouraged the first Mexican facilities to obtain licenses to incinerate and co-process ODS waste and proved the feasibility of ODS destruction using two different technologies: argon plasma arc and cement kiln. Mexico has two companies with the necessary authorizations from the Government, which were issued after satisfying relevant safety and environmental standards associated with ODS destruction.

30. The final report provides details on the phased implementation of the project. Preliminary activities consisted of training and recovery equipment endowment to home appliances replacement programme (HARP) centres, monitoring, reporting and verification (MRV) system design, awareness workshop, and implementation of ODS destruction pilot tests and licensing approval for two Mexican companies. Aggregation and consolidation of ODS banks were achieved and approximately 74.0 mt of unwanted CFC-12 banks were destroyed in the argon plasma; and an additional 39.0 mt were destroyed between 2016 and 2017. The cost-effectiveness based on implementation ranged from US \$8.0/kg to US \$9.20/kg.

31. The report states that the argon plasma arc is a cutting-edge destruction technology and is the cleanest; however, its limitation is the high cost. Cement kiln proved to be the most cost-effective ODS destruction technology, noting that the cement manufacturing industry in Mexico has a long experience in handling hazardous waste, other than ODS. Project lessons are provided in the final report.

#### Nepal: Pilot demonstration project for ODS waste management and disposal (UNEP)

32. The project for Nepal was approved by the Executive Committee at the 59<sup>th</sup> meeting to allow Nepal to explore two options for destroying a small amount of unwanted ODS that had been collected and stored through the national ozone unit. This ODS could not be sold in the market as it had been brought in above the country's allowable CFC consumption and was considered unwanted. As Nepal had a restriction for ODS re-export, the country had no option but to explore destruction possibilities.

33. The selected approach that the destruction project used was to export the ODS for destruction to the United States of America. This was done through a broker, EOS Climate, who organised the transfer to a licensed facility for destruction. UNEP reported that the shipment reached the United States of America in November 2012, and subsequently has been reported as destroyed as of February 2013. The amount of ODS handled in this project was 10 ODP tonnes (107,000 CO<sub>2</sub>-equivalent tonnes).

34. In March 2013, the Nepal project was submitted to the Climate Action Reserve (CAR). This has subsequently been listed in CAR with a reserve project identification number of CAR955. Upon further verification with the CAR website, the Secretariat noted the project has now changed status with CAR as registered, as of 24 May 2013. It has met final verification requirements of the CAR, and Climate Reserve Tonne (CRTs) may now be issued.<sup>8</sup>

35. In summarizing the demonstration value of the Nepal project, this provided an opportunity to link ODS destruction to the carbon market and explore the possibility of other financial mechanisms to support ODS destruction activities. The project's registration with the CAR is a good example for other countries who are pursuing this track for their ODS disposal projects. It also reported that one of the challenges that was faced during project implementation was the lengthy process to get approval for the export of the ODS

---

<sup>8</sup> Project developers submit a project by uploading the necessary forms and supporting documents to the Climate Action Reserve online software. The Reserve staff pre-screen projects for eligibility. Eligible projects are posted on the Reserve site with a status of "listed." The next step is verification by an independent, accredited verification body. Once completed, Reserve staff review the verification documentation, and if the project passes this final review process, it is labeled "registered", and CRTs are issued. Project developers submit a project by uploading the necessary forms and supporting documents to the Reserve online software. The Reserve staff pre-screen projects for eligibility. Eligible projects are posted on the Reserve site with a status of "listed." The next step is verification by an independent, accredited verification body. Once completed, Reserve staff review the verification documentation, and if the project passes this final review process, it is labeled "registered", and CRTs are issued.

to the United States of America, because of the legal impediments that required Parliamentary clearance.

Nigeria: Final report on the pilot demonstration project for disposal of unwanted ODS (UNIDO)

36. The objective of the pilot project is to demonstrate a sustainable business model for ODS waste management from collection to disposal using Multilateral Fund assistance as seed money to destroy current stock of unwanted ODS and generate carbon credits. These credits would be used to establish an Appliance Replacement Programme (for the replacement of existing domestic refrigerators and air-conditioners with more energy efficient ones), to sustain the current recovery and collection system for ODS, with the view to incorporate other refrigerants in the future. The project intended to destroy future ODS wastes through local incineration facilities whose capacity would be developed through the revenues generated from these carbon credits. The expected output from this project was the destruction of 84.0 mt of CFC-12 which had been reported as already collected during the project preparation from industrial sources, particularly from oil refineries.

37. An inception workshop took place in November 2013, with participation from government agencies, servicing companies, waste management companies and end-users. A local contractor was hired to aggregate ODS wastes in the country; a training workshop was provided to technicians on safe collection, transportation, and storage of ODS wastes including testing, correct labelling and documentation procedures; and a capacity building workshop for ODS collection and aggregation was held in June 2014. Companies and end-users that were identified during the preparatory phase were contacted to enquire about their stocks of ODS. However, stocks of ODS reported in most cases were not found. The total ODS collected amounted to only 1.66 mt of CFC-12. The collection activities were halted as no new stocks of CFC-12 were found and new inquiries repeatedly turned out to be halons (which are stored in Government agencies).

38. The revised ODS Regulations (2016) makes provisions for mandatory destruction of wastes, guidelines for destruction facilities including emission limits, and extends responsibility of end-of-life waste equipment to producers/suppliers. Extended Producer Responsibility regulations are now in place for the electronic/electrical sectors; thus, for new refrigerators, future recovery of refrigerants at their end-of-life should be the responsibility of the private sector. Training sessions on e-waste collection and management were carried out.

39. Officials from the Ministry of Environment and UNIDO inspected four disposal facilities and invited two of them to bid for the disposal of CFCs. The company selected has a proven track record of hazardous waste management for multinational companies and experience of managing CFC wastes specifically from collection to recycling. The collected stocks of CFC waste were tested for purity at the storage facility before loading, and transported to the destruction facility in Port Harcourt, Nigeria. The destruction process employed by the contracted facility is a rotary kiln incineration.

40. Of the total funds approved of US \$911,724, only US \$253,965 has been disbursed. Based on these disbursement, the actual cost of destruction for this project was US \$153/kg of ODS waste. The financial report will be updated once destruction is complete, and all outstanding payments are made. The balance of funds will be returned to the 82<sup>nd</sup> meeting.

Indonesia and the Philippines: Final reports of ODS disposal projects (World Bank)

41. At the 57<sup>th</sup> meeting, the Executive Committee approved funds for the preparation of pilot demonstration projects for ODS waste management and disposal for Indonesia and the Philippines. At that meeting, the World Bank had indicated that these funds would be used to generate data and experience on management and financing modalities and would examine opportunities to leverage co-financing.

42. The World Bank submitted final reports containing material describing the current ODS waste inventories for Indonesia and the Philippines, information on how to do inventories and data collection, guidance on the management of unwanted ODS, financing options for destroying unwanted ODS including information about available markets, cost considerations and market prices. The reports also contain specific options for each country, an evaluation of these options, and the next steps that would be needed for implementation.

Turkey: Final report on the demonstration project for disposal of unwanted ODS (UNIDO)

43. The objective of the project was to establish a sustainable and integrated business model for an efficient waste management system of ODSs, through institutional measures that will organize the existing recovery and collection systems in the country into an integrated and efficient collection validation and valuation system.

44. Turkey had already collected some ODS wastes through Government-authorized recovery and reclamation centres established in three cities, Ankara (TUHAB), Istanbul (ISISO) and Izmir (ESSIAD); the expected amount of ODS wastes to be destroyed was 103.72 mt of CFC-12. However, during implementation, it was found that the ODS wastes available were in many cases mixtures of all types of refrigerants and the actual amount available for destruction was 9.162 mt of CFC-12.

45. The project had envisaged exporting the ODS waste to the United States of America for destruction; however, the absence of expected revenue from carbon markets, and the very small amounts of ODS wastes to be destroyed led to a redesign of the disposal strategy. It was decided to destroy the collected waste in Europe through an international bidding process.

46. In order to be more cost-effective, the ODS wastes from Turkey was combined with that of ODS waste from Montenegro; the latter was part of the regional demonstration project for ODS waste disposal pilot project for the Europe and Central Asia (ECA) region also funded by the Multilateral Fund. Other activities such as sharing of lessons learned, awareness raising were also done in close cooperation with the ECA region.

47. The project resulted in the destruction of 9.162 mt of CFC-12, reported an expenditure of US \$598,345 out of the approved US \$1,076,250 (plus agency support costs), resulting in a cost-effectiveness of US \$65/kg of ODS wastes destroyed.

ECA region: Demonstration of a regional strategy for ODS waste management and disposal (UNIDO)

48. The objective of the pilot demonstration project for three countries – Bosnia and Herzegovina, Croatia and Montenegro in the ECA – was to evaluate a regional approach for ODS waste disposal in terms of cost-effectiveness and sustainability, particularly in LVC countries that do not have their own ODS destruction facilities.

49. The project aimed at destroying 29.07 mt of ODS waste from the three countries. It collected mainly CFCs, HCFCs and small amounts of HFCs. A total of 41.37 mt of waste were destroyed, including 32.79 mt of ODS waste. It was not feasible to separate ODS waste from non-ODS waste, meaning that all collected quantities were destroyed under the project. The cost-effectiveness of the project was US \$8.01/kg calculated based only on the portion of ODS waste destroyed, exceeding the expected cost-effectiveness of US \$12.02/kg. Therefore, the overall cost estimate of the project is US \$262,622, and any balances will be returned to the Multilateral Fund after financial completion of the project.

50. The final report highlights that both legislation and institutional arrangements of the beneficiary countries did not support the aggregation of ODS waste at the regional level, synchronization of the shipments from different countries, and synergies with persistent organic pollutants (POPs) destruction.



51. The project facilitated the establishment of the Regional Cooperation Forum (RCF) as a communication platform that provided, *inter alia*, a list of equipment and tools that are necessary for proper aggregation of waste; check list for laboratory analysis of ODS waste; list of eligible destruction facilities in the European Union (EU); and recommendations and lessons learned.

52. Some lessons include improved knowledge on legislation in the EU and project countries, which does not allow the aggregation of ODS waste at regional level because ODS waste is classified as hazardous waste; the need for national legislation of the country in which destruction is to take place to allow the import of waste mixtures containing ODS for destruction; a list of destruction facilities in EU countries that accept waste mixtures containing ODS for destruction would be useful to other countries in the ECA region; and environmental taxes on refrigerants contributing to ozone layer depletion and climate change might feed into environmental funds to finance the environmentally sound disposal of refrigerant waste in the long-term.

---